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HARRINGTON & SMITH

NO. 676 P. 2

S.N. 10/099,626
Art Unit: 2685

IN THE CLAIMS

1. (Currently Amended) A method for operating a radio frequency ~~RF receiver apparatus~~ of a communications equipment, comprising:

under the control of a data processor of the communications equipment,

generating a calibration signal;

injecting the calibration signal into a ~~low noise~~ amplifier LNA of the ~~RF receiver apparatus~~;

measuring a downconverted response of the ~~receiver~~RF apparatus at a plurality of different internal states of the ~~receiver~~RF apparatus using at least one frequency of the calibration signal; and

at least one of tuning a resonance frequency of at least one LNA resonator based on the measured downconverted response so as to compensate at least for variations in component values that comprise the at least one resonator, or adjusting the linearity of the ~~receiver~~RF apparatus.

2. (Currently Amended) A method as in claim 1, where the calibration signal is generated using a frequency synthesizer of the communications equipment.

3. (Currently Amended) A method as in claim 1, where the calibration signal is generated using an oscillator that comprises said at least one LNA resonator.

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4. (Original) A method as in claim 1, where the resonance frequency is tuned based on a strongest measured downconverted response, and where the linearity is adjusted based on a weakest downconverted response.

5. (Currently Amended) A method as in claim 1, where the step of tuning a resonance frequency of the at least one LNA resonator comprises also fine tuning the resonance to compensate for variations in power supply current using one of predetermined information or executing the calibration procedure at different power supply current levels.

6. (Currently Amended) A method as in claim 1, where generating the calibration signal comprises generating a modulated calibration signal, and where adjusting the linearity of the receiver RF apparatus comprises making an adjustment for either the second order input intercept point IIP2 or the third order input intercept point IIP3.

7. (Currently Amended) A method as in claim 1, where an output of the LNA amplifier is coupled to an input of a downconversion mixer, and where the step of measuring observes an output of a received signal strength indicator RSSI that is located downstream from the downconversion mixer.

8. (Currently Amended) A method as in claim 1, where the receiver RF apparatus is a direct conversion receiver, where an output of the LNA amplifier is coupled to an input of a downconversion mixer, and where the calibration signal is modulated so as to avoid the generation of a DC or a passband signal at the output of the downconversion mixer during normal downconversion operation.

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9. (Original) A method as in claim 1, where generating the calibration signal comprises attenuating the calibration signal.

10. (Currently Amended) A method as in claim 1, where injecting the calibration signal includes disabling a normal received signal input to the LNAamplifier.

11. (Original) A method as in claim 1, where the communications equipment comprises a mobile station that operates in accordance with a TDMA protocol.

12. (Original) A method as in claim 1, where the communications equipment comprises a mobile station that operates in accordance with a CDMA protocol.

13. (Currently Amended) A method as in claim 1, where the RF receiver-apparatus comprises a direct conversion receiver, and where the communications equipment comprises a mobile station that operates in accordance with a CDMA protocol.

14. (Original) A method as in claim 1, where the communications equipment comprises a base station that operates in accordance with one of a TDMA protocol or a CDMA protocol.

15. (Original) A method as in claim 1, and further comprising changing the resonance frequency after calibrating, and during normal operation, based on a current local oscillator frequency.

16. (Currently Amended) A radio frequency RF receiver-apparatus of a communications equipment, comprising calibration circuitry that operates under control of a data processor of

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said communications equipment for calibrating RF circuitry of said communications equipment ~~in the field~~, said calibration circuitry comprising a source of a RF calibration signal and circuitry for coupling ~~a~~said RF receiver calibration signal to a ~~low noise~~amplifier LNA of said RF receiver~~apparatus~~; said calibration circuitry further comprising circuitry for measuring a downconverted response of said RF receiver~~apparatus~~ at a plurality of different internal states of said receiver~~RF apparatus~~ using at least one frequency of the RF calibration signal and for performing at least one of tuning a resonance frequency of at least one LNA resonator~~resonator~~ based on the measured downconverted response so as to ~~at least one of~~ compensate at least for variations in component values that comprise said at least one resonator, or for adjusting the linearity of said RF receiver~~apparatus~~.

17. (Currently Amended) A RF receiver~~apparatus~~ as in claim 16, where said calibration signal source comprises a frequency synthesizer of said communications equipment.

18. (Currently Amended) A RF receiver~~apparatus~~ as in claim 16, where said calibration signal source comprises an oscillator that in turn comprises said at least one LNA resonator~~resonator~~.

19. (Currently Amended) A RF receiver~~apparatus~~ as in claim 16, where said resonance frequency is capable of being tuned based on a strongest measured downconverted response, and where said linearity is capable of being adjusted based on a weakest downconverted response.

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20. (Currently Amended) A RF receiverapparatus as in claim 16, where said circuitry for tuning said resonance frequency also fine tunes said resonance to compensate for variations in power supply current using one of predetermined information or executing the calibration procedure at different power supply current levels.

21. (Currently Amended) A RF receiverapparatus as in claim 16, and further comprising a modulator for modulating said calibration signal, and where said circuitry for adjusting said linearity of said RF receiverapparatus comprises making an adjustment for either a second order input intercept point IIP2 or a third order input intercept point IIP3.

22. (Currently Amended) A RF receiverapparatus as in claim 16, where an output of said LNAamplifier is coupled to an input of a downconversion mixer, and where said measuring circuitry observes an output of a received signal strength indicator RSSI that is located downstream from said downconversion mixer.

23. (Currently Amended) A RF receiverapparatus as in claim 16, where said RF receiverapparatus is a direct conversion receiver, where an output of said LNAamplifier is coupled to an input of a downconversion mixer, and where said calibration signal is modulated to avoid generating a DC signal or a passband at an output of said downconversion mixer during normal downconversion operation.

24. (Currently Amended) A RF receiverapparatus as in claim 16, where said source comprises an attenuator for attenuating an output of a frequency synthesizer to provide said calibration signal.

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25. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where when said calibration signal is coupled to said ~~LNAamplifier~~ a normal received signal input to said ~~LNAamplifier~~ is disabled.

26. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where said communications equipment comprises a mobile station that operates in accordance with a TDMA protocol.

27. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where said communications equipment comprises a mobile station that operates in accordance with a CDMA protocol.

28. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where said RF ~~receiverapparatus~~ comprises a direct conversion receiver, and where said communications equipment comprises a mobile station that operates in accordance with a CDMA protocol.

29. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where said communications equipment comprises a base station that operates in accordance with one of a TDMA protocol or a CDMA protocol.

30. (Currently Amended) A RF ~~receiverapparatus~~ as in claim 16, where said communications equipment changes the resonance frequency after calibrating, and during normal operation, based on a current local oscillator frequency.

31.-32. (Canceled)

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33. (Currently Amended) A method for operating a radio frequency RF receiverapparatus of a communications equipment, comprising:

under the control of a data processor of the communications equipment,

generating a fixed calibration signal;

injecting the fixed calibration signal into a low-noisean amplifier LNA of the RF receiverapparatus;

tuning the LNAamplifier to a plurality of different tuning points and measuring a corresponding downconverted response of the RF receiverapparatus; and

at least one of tuning a resonance frequency of at least one LNA resonatorresonator based on the measured downconverted response so as to compensate at least for variations in component values that comprise the at least one resonator, or adjusting the linearity of the RF apparatusreceiver.

34. (Original) A method as in claim 33, where the calibration signal is generated using a frequency synthesizer of the communications equipment.

35. (Currently Amended) A method as in claim 33, where the calibration signal is generated using an oscillator that comprises said at least one LNA resonatorresonator.

36. (Original) A method as in claim 33, where the resonance frequency is tuned based on a strongest measured downconverted response, and where the linearity is adjusted based on a weakest downconverted response.

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37. (Original) A method as in claim 33, and further comprising changing the resonance frequency after calibrating, and during normal operation, based on a current local oscillator frequency.

38. (Canceled)

39. (Currently Amended) A method for operating a mobile station comprising, during a time that an RF apparatus receiver is required, operating a data processor of said mobile station for enabling an receiver low noise amplifier LNA in said RF apparatus, generating a calibration signal within said mobile station, coupling said calibration signal into said receiver RF apparatus, measuring a downconverted response of the receiver RF apparatus to said calibration signal, and at least one of tuning a resonance frequency of at least one LNA resonator resonator based on the measured downconverted response, or adjusting the linearity of a receiver chain in said RF apparatus.

40. (Original) A method as in claim 39, where the downconverted calibration signal is located outside of a receiver passband transfer function so that the calibration signal is not totally rejected.

41. (Original) A method as in claim 39, where the downconverted calibration signal is separated from the received signal spectrum by bandpass filtering in the digital domain.

42. (New) A radio frequency RF apparatus of a communications equipment, comprising calibration means that operates under control of a data processor of said communications equipment for calibrating RF circuitry of said communications equipment, said calibration means comprising a means for sourcing a RF calibration signal and means for coupling said

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RF calibration signal to an amplifier of said RF apparatus; said calibration circuitry further comprising means for measuring a downconverted response of said RF apparatus at a plurality of different internal states of said RF apparatus using at least one frequency of the RF calibration signal and means for performing at least one of tuning a resonance frequency of at least one resonator based on the measured downconverted response so as to compensate at least for variations in component values that comprise said at least one resonator, or adjusting linearity of said RF apparatus.

43. (New) The RF apparatus of claim 42, wherein the means for measuring a downconverted response further comprises means for tuning the amplifier to a plurality of different tuning points and means for measuring a corresponding downconverted response of the RF apparatus.

44. (New) A communications equipment comprising:

 a memory comprising a program comprising machine-readable instructions;
 and

 a data processor coupled to the memory and coupleable to a radio frequency RF apparatus comprising a source configured to generate a calibration signal, circuitry configurable to couple the calibration signal to an amplifier, the amplifier, and at least one resonator, the data processor configured to execute the program, the program comprising operations of:

 configuring the source to generate a calibration signal;

 configuring the circuitry to inject the calibration signal into the amplifier of the RF apparatus;

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measuring a downconverted response of the RF apparatus at a plurality of different internal states of the RF apparatus using at least one frequency of the calibration signal; and

at least one of tuning a resonance frequency of at least one resonator based on the measured downconverted response so as to compensate at least for variations in component values that comprise the at least one resonator, or adjusting linearity of the RF apparatus.

45 (New) The communications equipment of claim 44, wherein the operation of measuring a downconverted response further comprises tuning the amplifier to a plurality of different tuning points and measuring a corresponding downconverted response of the RF apparatus.

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